CLAIMS

1. A recombinant expression system capable, when transformed into an organism, of expressing a gene encoding a nonsymbiotic hemoglobin, which system comprises a nucleotide sequence encoding said nonsymbiotic hemoglobin operably linked to control sequences effective in said organism.

2. The system according to claim 1 wherein the control sequences include a strong constitutive promoter.

3. The system according to claim 1 wherein the nonsymbiotic hemoglobin is barley hemoglobin.

4. The system according to claim 1 wherein the organism is a plant.

5. The system according to claim 4 wherein the plant is maize.

6. The system according to claim 5 wherein the promoter is maize ubiquitin promoter.

7. The system according to claim 1 wherein the organism is a bacteria.

8. The system according to claim 7 wherein the bacteria is an obligate aerobe.

9. The system according to claim 7 wherein the bacteria is *P. aeruginosa*.

10. Cells transformed with the expression system according to any one of claims 1 to 9.

11. A transgenic organism whose genome has been modified to contain the expression system according to any one of claims 1 to 9.

12. A method of increasing tolerance to hypoxic conditions comprising:

providing an organism having increased cellular levels of an oxygen-binding protein having a low dissociation constant for oxygen; and

placing the organism under hypoxic conditions,

wherein the oxygen-binding protein acts to maintain cellular energy status during the hypoxic conditions by making oxygen available for cellular metabolism at low oxygen tension.

13. A method of lowering the level of fermentation products in an organism comprising:

providing an organism having increased cellular levels of an oxygen-binding protein having a low dissociation constant for oxygen; and

reducing the level of fermentation products in the cells of the organism by maintaining cell energy status such that fermentation is bypassed.

14. A method of maintaining cellular metabolism under hypoxic conditions comprising:

providing an organism having increased cellular levels of an oxygen-binding protein having a low dissociation constant for oxygen; and

placing the organism under hypoxic conditions,

wherein the oxygen-binding protein acts to maintain cellular metabolism status by providing oxygen for cellular metabolism.

15. A method of increasing oxygen uptake of an organism comprising:

providing an organism having increased cellular levels of an oxygen-binding protein having a low dissociation constant for oxygen; and

exposing the organism to an oxygen-containing environment,

wherein the increased cellular levels of the oxygen-binding protein results in increased oxygen uptake.

16. A method of improving the agronomic properties of a plant comprising:

providing a plant having increased cellular levels of an oxygen-binding protein having a low dissociation constant for oxygen; and

growing the plant.

17. The method according to claim 16 wherein the improved agronomic properties include germination.

18. The method according to claim 16 wherein the improved agronomic properties include seedling vigour.

19. The method according to claim 16 wherein the improved agronomic properties include reduced cellular levels of fermentation products.

20. The method according to claim 16 wherein the improved

agronomic properties include increased oxygen uptake.

21. The method according to claim 16 wherein the improved agronomic properties include increased tolerance to hypoxic conditions.

22. A method of performing skin grafts comprising:

isolating skin cells from a patient;

transfecting the skin cells with an expression system comprising a nucleotide sequence encoding an oxygen binding protein having a low dissociation constant for oxygen operably linked to control sequences effective in skin cells;

culturing the skin cells such that the oxygen binding protein is expressed; and

grafting the skin cells onto a region of skin tissue attached to the patient.

23. A method of transplanting an organ from a donor to a recipient comprising:

providing an organ for transplant;

infusing the organ with an oxygen binding protein having a low dissociation constant for oxygen, thereby improving oxygen supply to the organ; and

transplanting the organ into the recipient.

24. The method according to any one of claims 12 to 23 wherein the oxygen binding protein having a low dissociation constant for oxygen is a nonsymbiotic hemoglobin.

25. The method according to claim 24 wherein the nonsymbiotic hemoglobin is barley hemoglobin.

26. A method of selecting seeds for breeding to produce seed lines having desirable characteristics comprising:

providing a representative seed of a given seed line;

growing the seed such that the seed germinates;

isolating an extract from the seed;

measuring levels of hemoglobin expression within the extract; and

selecting or rejecting the seed for further breeding based on the hemoglobin levels.

27. A method of determining if a seed is germinating comprising:

providing a seed suspected of germinating;

isolating an extract from the seed; and

measuring levels of hemoglobin expression within the extract,

wherein high levels of hemoglobin expression indicate that the seed is germinating.

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